FIG. 1

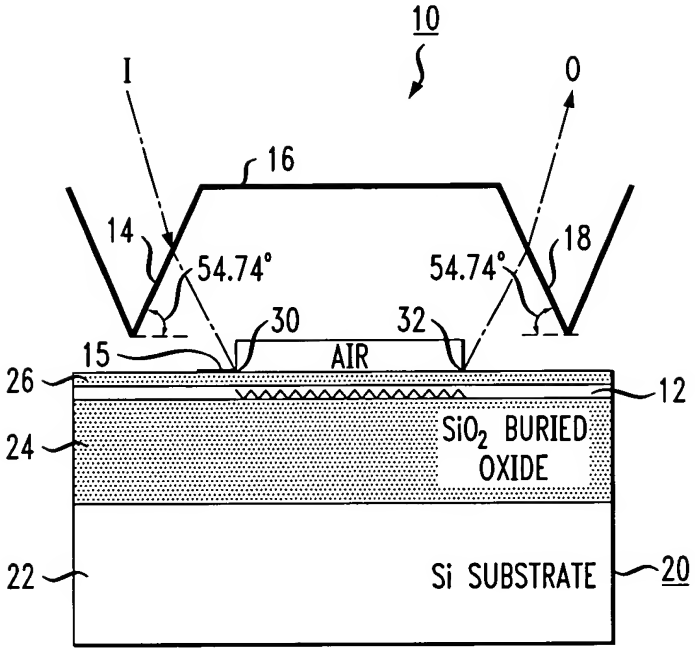


FIG. 2

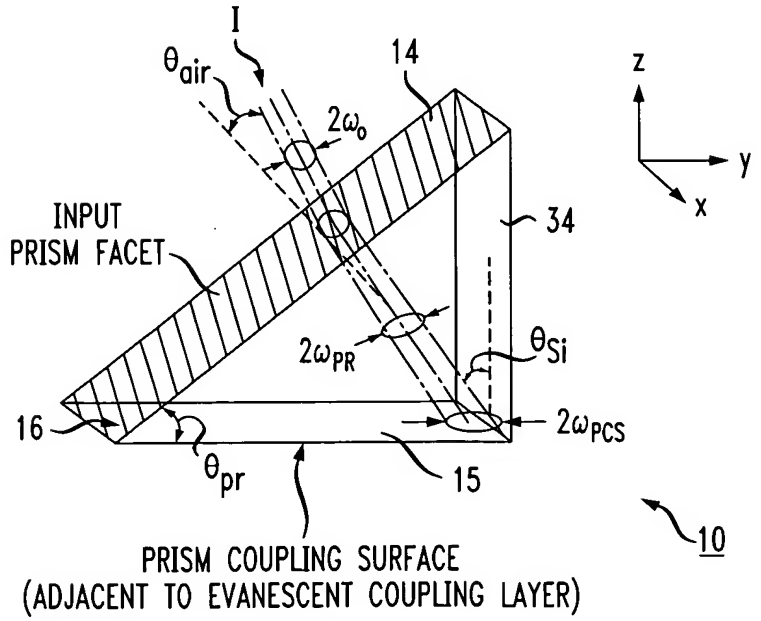


FIG. 3

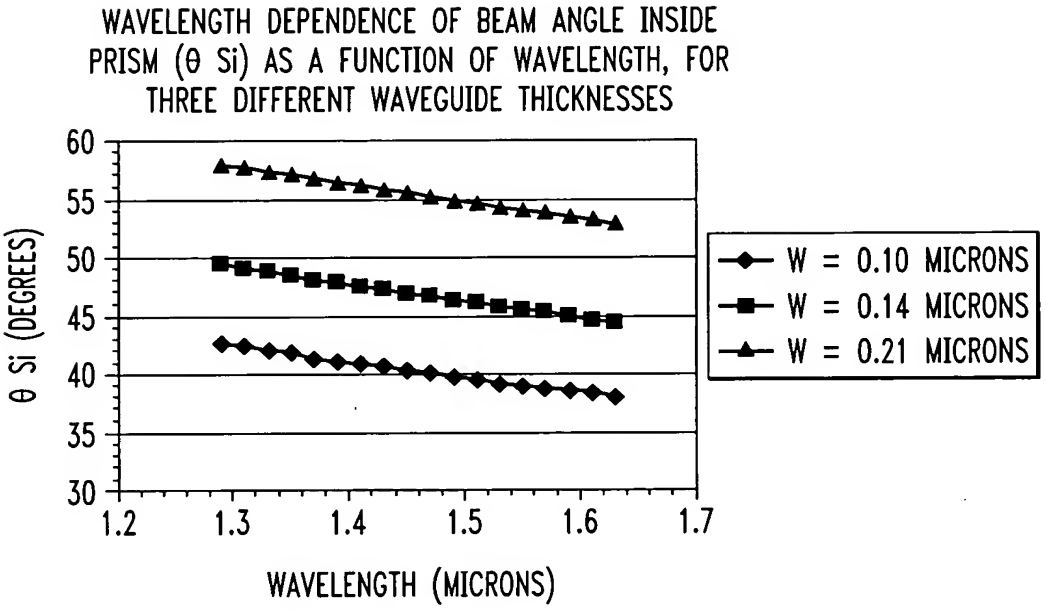

WAVELENGTH DEPENDENCE OF BEAM ANGLE INSIDE PRISM (θ Si) AS A FUNCTION OF WAVELENGTH, FOR THREE DIFFERENT WAVEGUIDE THICKNESSES
θ Si (DEGREES)
60
55
50
45
40
35
30
1.2
1.3
1.4
1.5
1.6
1.7
WAVELENGTH (MICRONS)
W = 0.10 MICRONS
W = 0.14 MICRONS
W = 0.21 MICRONS

FIG. 4

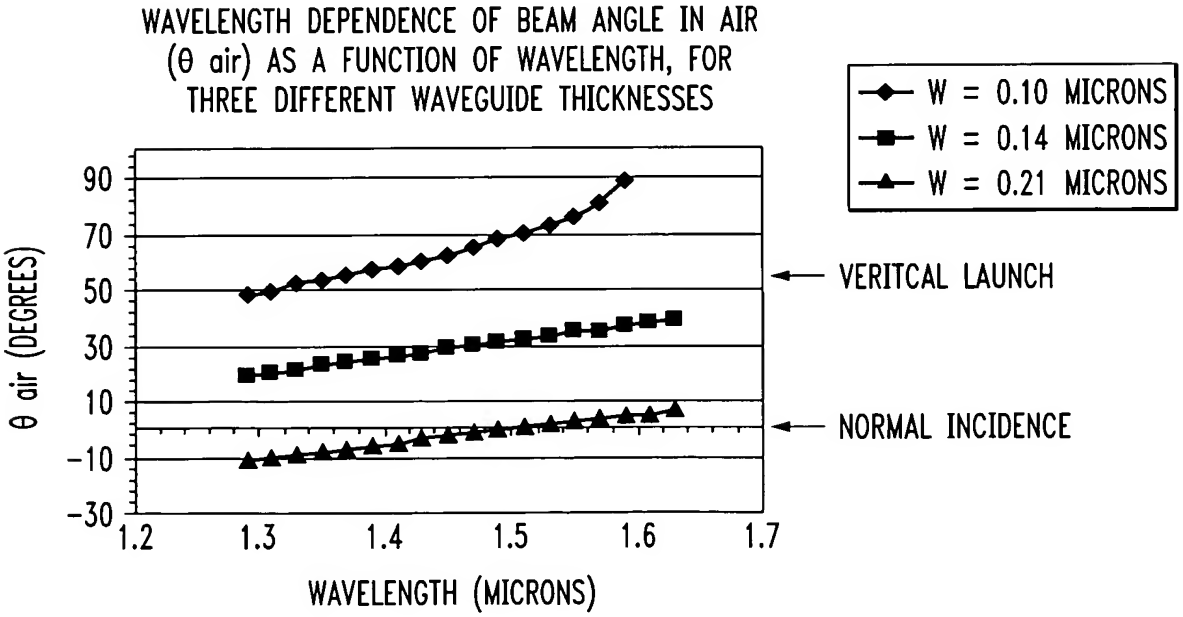

WAVELENGTH DEPENDENCE OF BEAM ANGLE IN AIR (θ air) AS A FUNCTION OF WAVELENGTH, FOR THREE DIFFERENT WAVEGUIDE THICKNESSES
θ air (DEGREES)
90
70
50
30
10
-10
-30
1.2
1.3
1.4
1.5
1.6
1.7
WAVELENGTH (MICRONS)
W = 0.10 MICRONS
W = 0.14 MICRONS
W = 0.21 MICRONS
VERITCAL LAUNCH
NORMAL INCIDENCE

FIG. 5

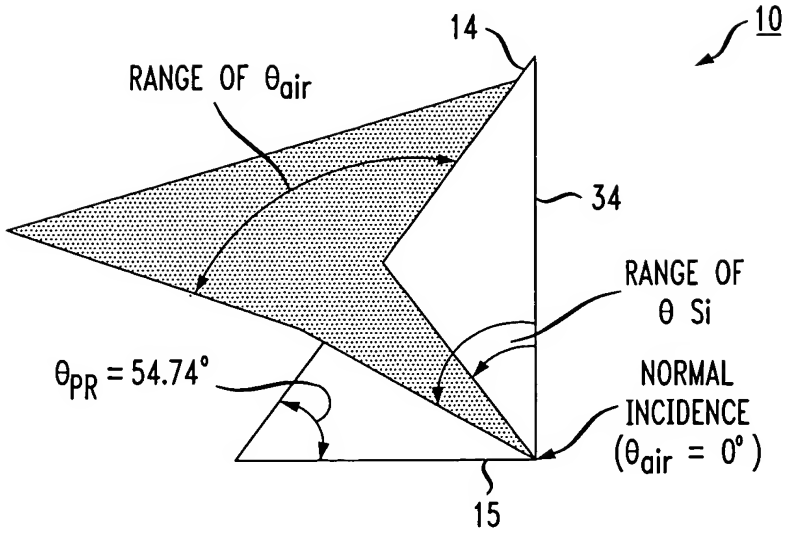

14
10
RANGE OF θair
34
RANGE OF
θ Si
θPR = 54.74°
NORMAL
INCIDENCE
(θair = 0°)
15

FIG. 6

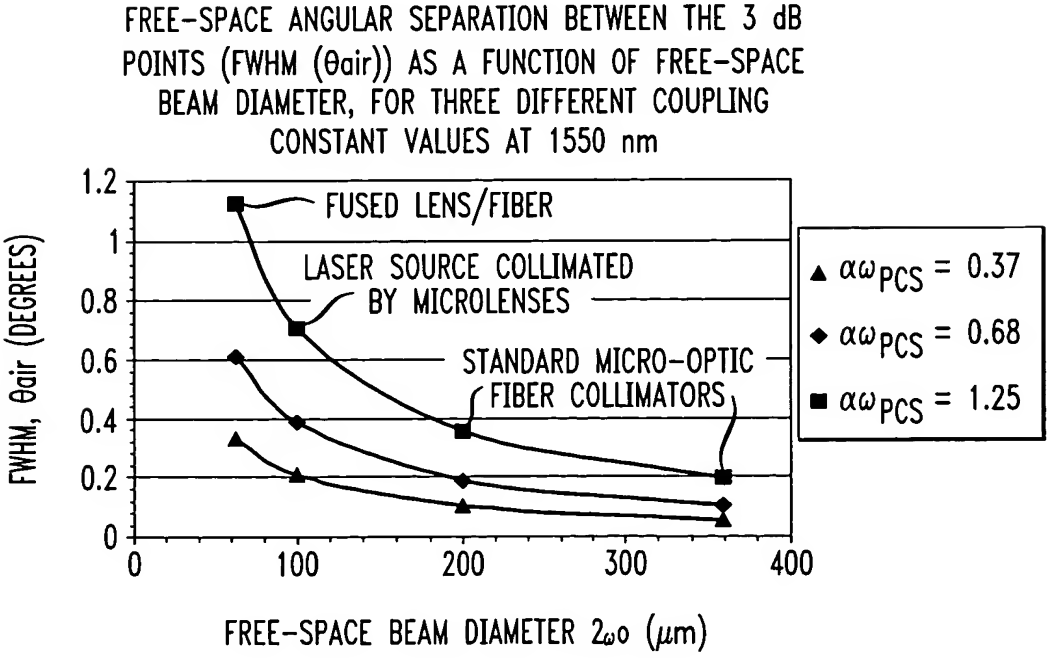

FREE-SPACE ANGULAR SEPARATION BETWEEN THE 3 dB POINTS (FWHM (θair)) AS A FUNCTION OF FREE-SPACE BEAM DIAMETER, FOR THREE DIFFERENT COUPLING CONSTANT VALUES AT 1550 nm
FWHM, θair (DEGREES)
1.2
1
0.8
0.6
0.4
0.2
0
0
100
200
300
400
FREE-SPACE BEAM DIAMETER 2ωo (μm)
FUSED LENS/FIBER
LASER SOURCE COLLIMATED BY MICROLENSES
STANDARD MICRO-OPTIC FIBER COLLIMATORS
▲ αωPCS = 0.37
◆ αωPCS = 0.68
■ αωPCS = 1.25

FIG. 7

n = 1.45 FOR EVANESCENT LAYER

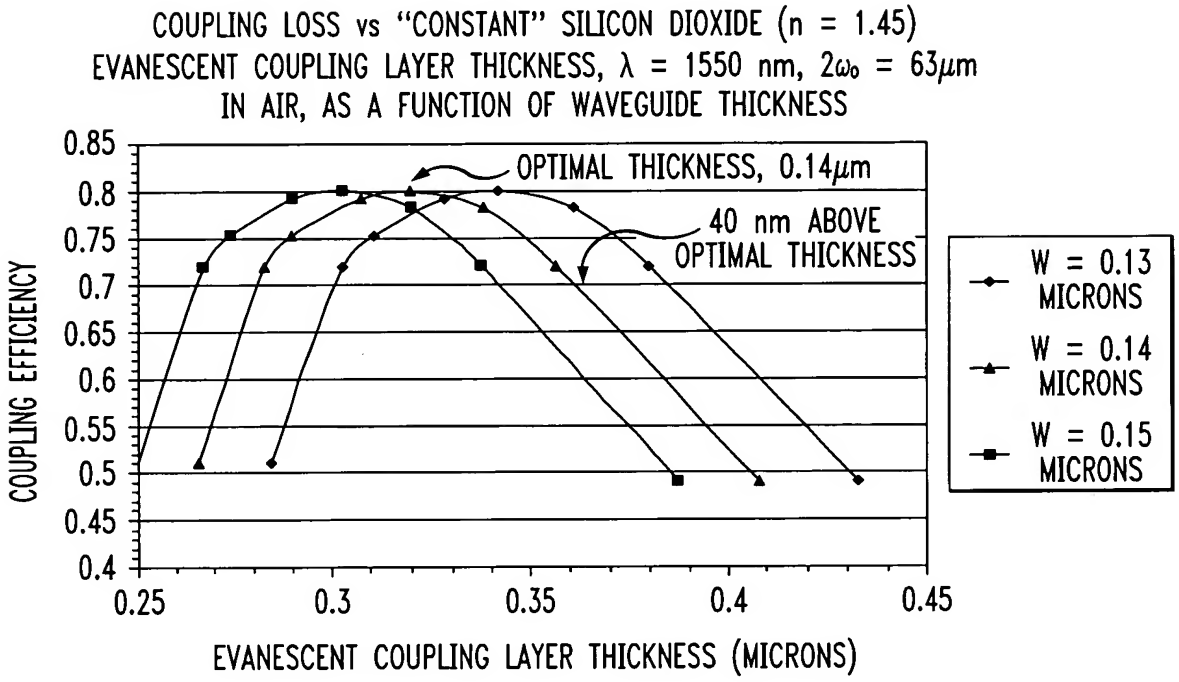


FIG. 8

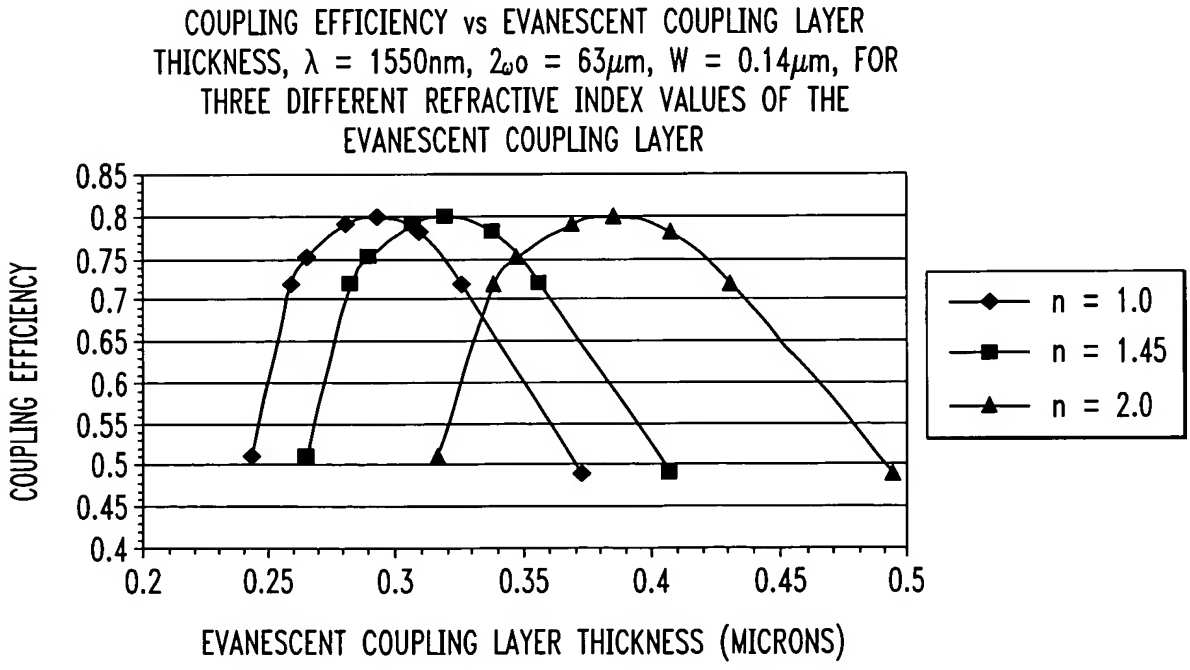


FIG. 9

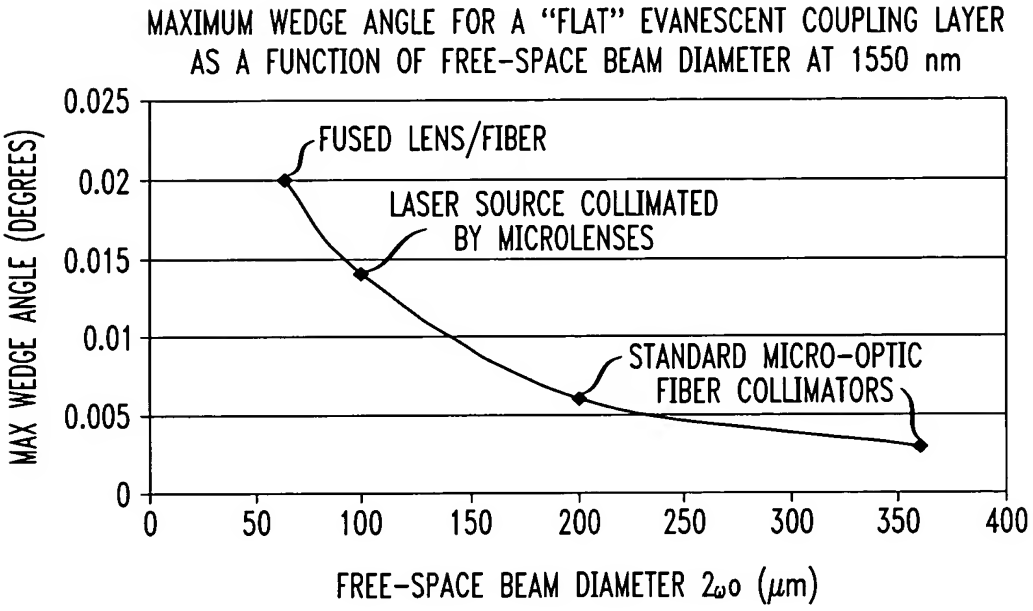

MAXIMUM WEDGE ANGLE FOR A "FLAT" EVANESCENT COUPLING LAYER AS A FUNCTION OF FREE-SPACE BEAM DIAMETER AT 1550 nm
MAX WEDGE ANGLE (DEGREES)
0.025
0.02
0.015
0.01
0.005
0
FUSED LENS/FIBER
LASER SOURCE COLLIMATED BY MICROLENSES
STANDARD MICRO-OPTIC FIBER COLLIMATORS
0
50
100
150
200
250
300
350
400
FREE-SPACE BEAM DIAMETER 2ωo (μm)

FIG. 10

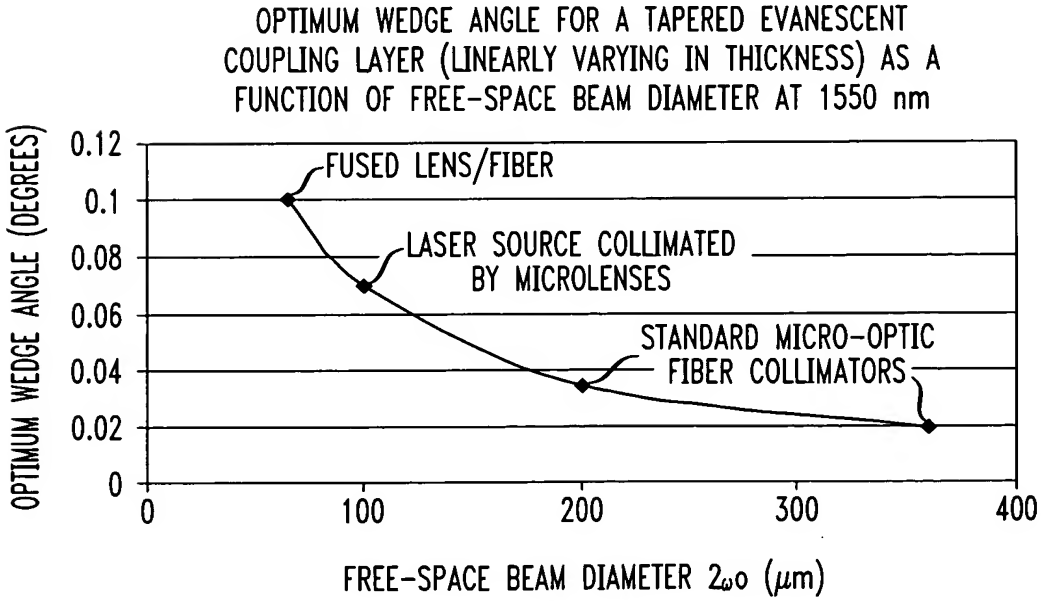

OPTIMUM WEDGE ANGLE FOR A TAPERED EVANESCENT COUPLING LAYER (LINEARLY VARYING IN THICKNESS) AS A FUNCTION OF FREE-SPACE BEAM DIAMETER AT 1550 nm
OPTIMUM WEDGE ANGLE (DEGREES)
0.12
0.1
0.08
0.06
0.04
0.02
0
FUSED LENS/FIBER
LASER SOURCE COLLIMATED BY MICROLENSES
STANDARD MICRO-OPTIC FIBER COLLIMATORS
0
100
200
300
400
FREE-SPACE BEAM DIAMETER 2ωo (μm)

FIG. 11

GRAPHS OF $2\omega_{PCS}/2\omega_o = \{1-(\sin\theta_{air}/n_{Si})^2\}^{1/2}/\{\cos\theta_{air} * \cos\theta_{Si}\}$

RATION OF PROJECTION OF INPUT BEAM ON PRISM COUPLING SURFACE TO FREE SPACE BEAM SIZE, AS A FUNCTION OF WAVELENGTH FOR 4 DIFFERENT WAVEGUIDE THICKNESSES OF THE EMBODIMENT SHOWN IN FIGURE 2.1, WITH θpr = 54.74 DEGREES

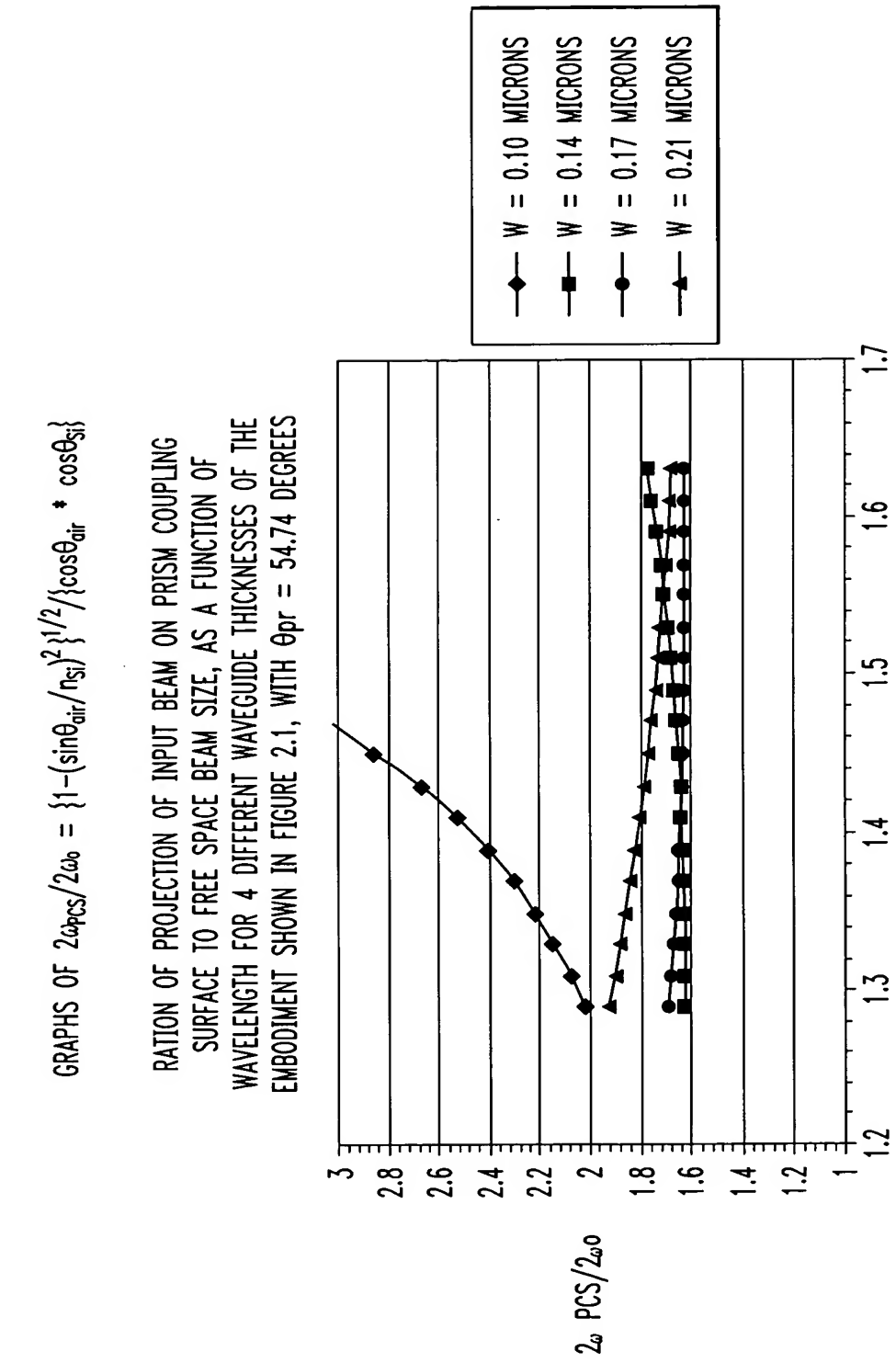
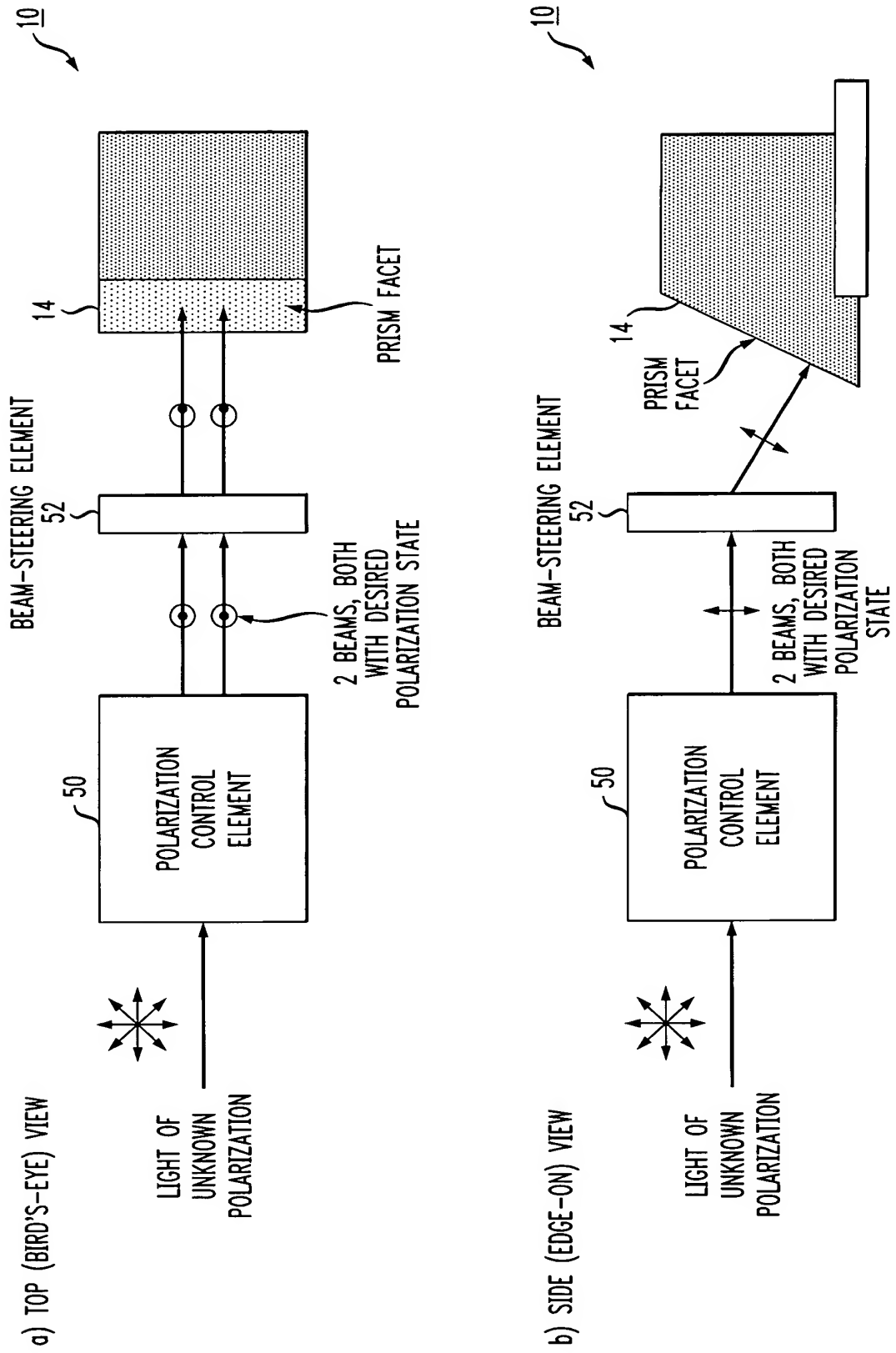


FIG. 12


a) TOP (BIRD'S-EYE) VIEW
b) SIDE (EDGE-ON) VIEW
10
14
PRISM FACET
BEAM-STEERING ELEMENT
52
2 BEAMS, BOTH WITH DESIRED POLARIZATION STATE
50
POLARIZATION CONTROL ELEMENT
LIGHT OF UNKNOWN POLARIZATION

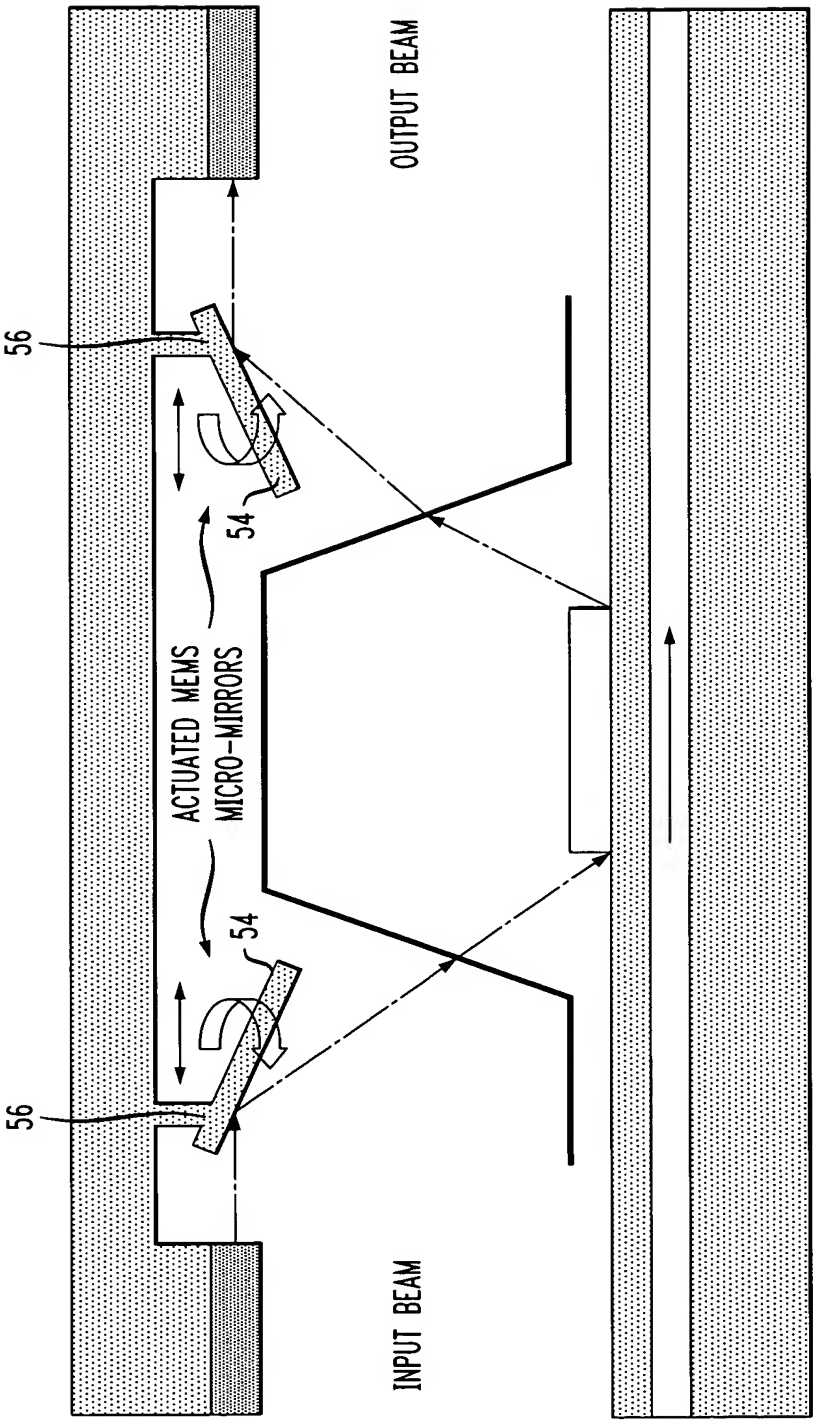

OUTPUT BEAM
56
54
ACTUATED MEMS
MICRO-MIRRORS
54
56
INPUT BEAM

FIG. 13

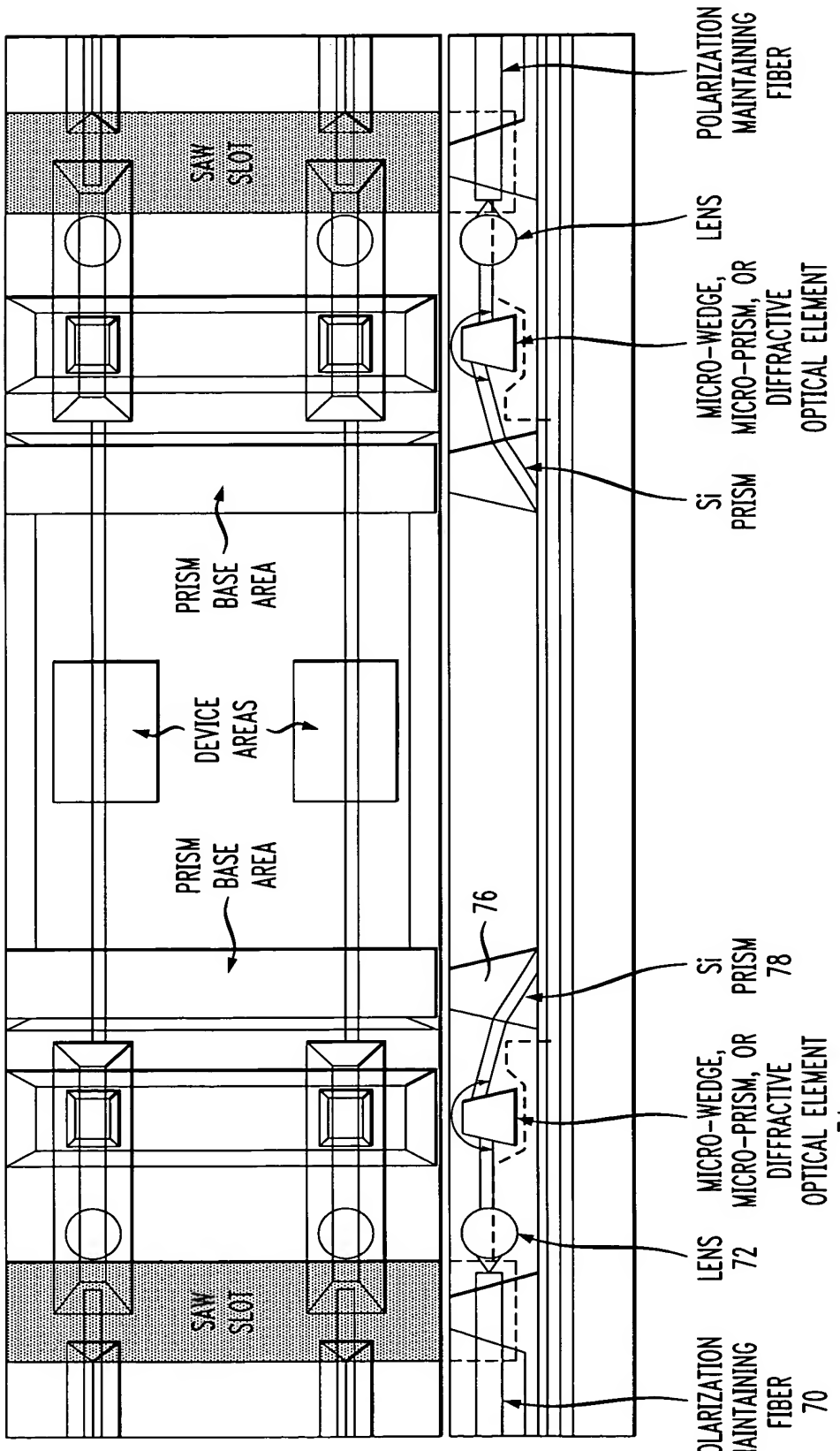
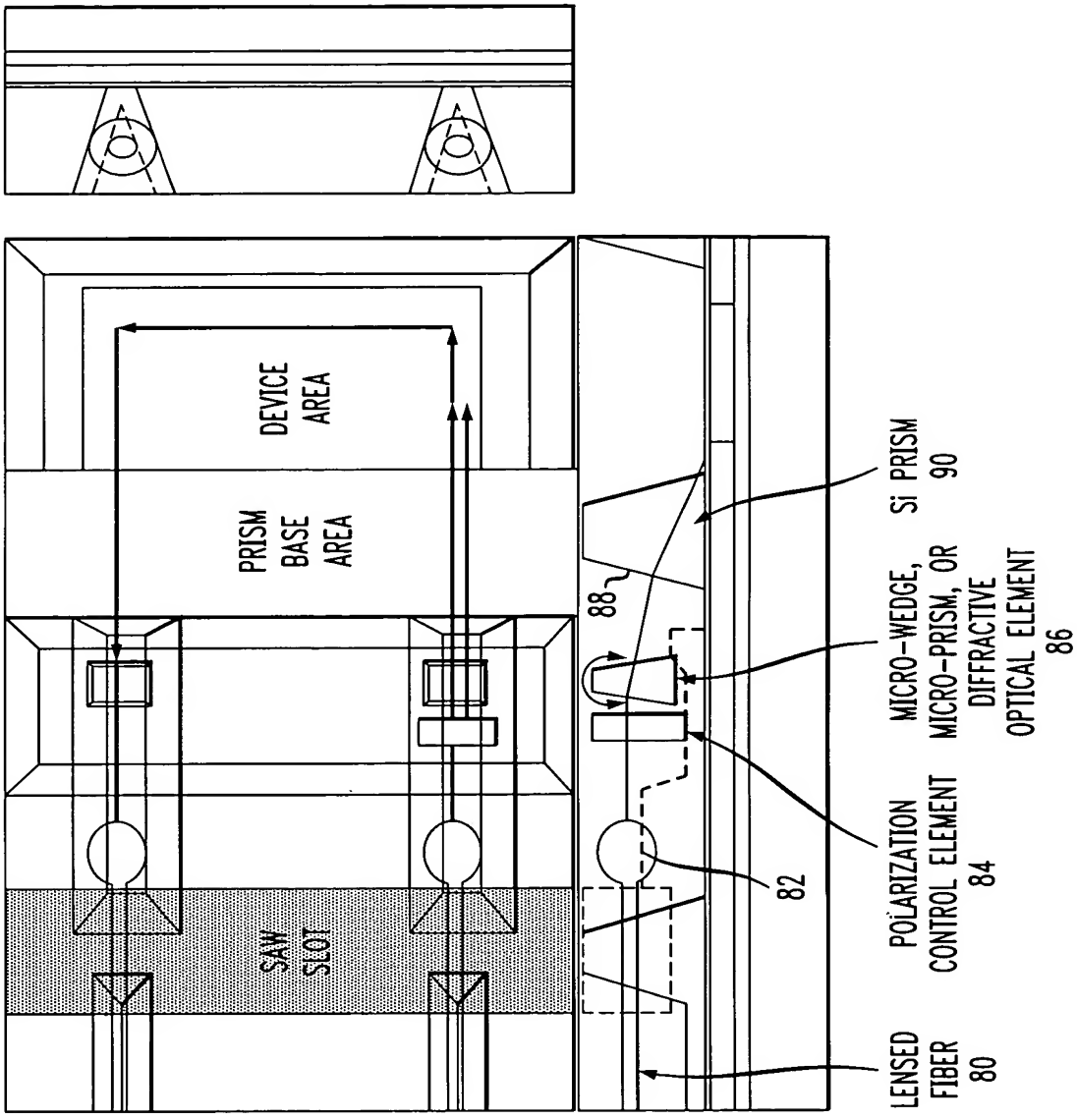

SAW SLOT
PRISM BASE AREA
DEVICE AREAS
PRISM BASE AREA
SAW SLOT
76
POLARIZATION MAINTAINING FIBER
LENS
MICRO-WEDGE, MICRO-PRISM, OR DIFFRACTIVE OPTICAL ELEMENT
Si PRISM
Si PRISM 78
MICRO-WEDGE, MICRO-PRISM, OR DIFFRACTIVE OPTICAL ELEMENT 74
LENS 72
POLARIZATION MAINTAINING FIBER 70

FIG. 14

FIG. 15


DEVICE AREA
PRISM BASE AREA
SAW SLOT
88
82
LENSED FIBER 80
POLARIZATION CONTROL ELEMENT 84
MICRO-WEDGE, MICRO-PRISM, OR DIFFRACTIVE OPTICAL ELEMENT 86
Si PRISM 90

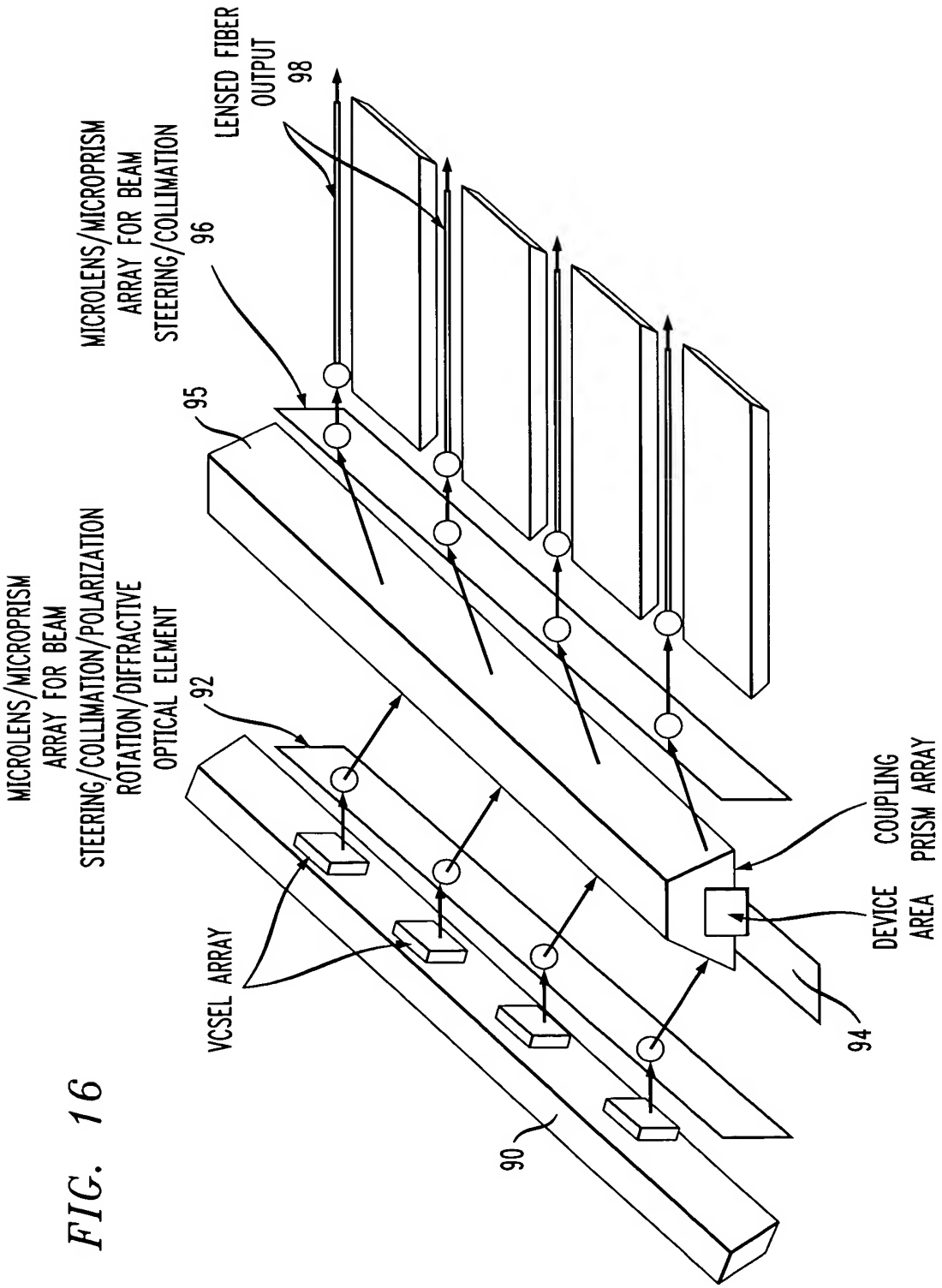

LENSED FIBER OUTPUT
98
MICROLENS/MICROPRISM ARRAY FOR BEAM STEERING/COLLIMATION
96
95
MICROLENS/MICROPRISM ARRAY FOR BEAM STEERING/COLLIMATION/POLARIZATION ROTATION/DIFFRACTIVE OPTICAL ELEMENT
92
VCSEL ARRAY
90
DEVICE COUPLING AREA PRISM ARRAY
94

FIG. 16

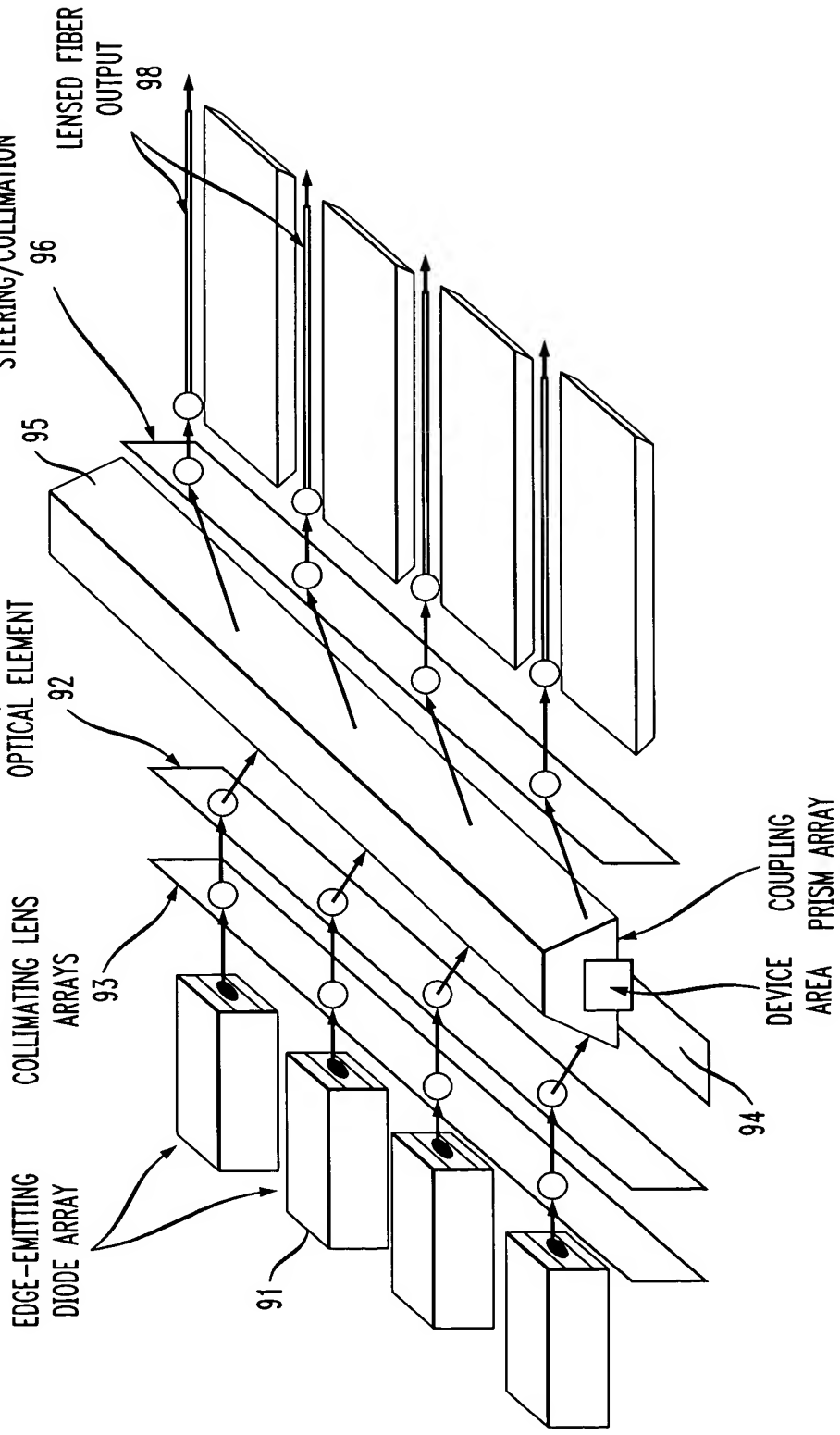

LENSED FIBER OUTPUT
98
MICROLENS/MICROPRISM ARRAY FOR BEAM STEERING/COLLIMATION
96
95
MICROLENS/MICROPRISM ARRAY FOR BEAM STEERING/COLLIMATION/POLARIZATION ROTATION/DIFFRACTIVE OPTICAL ELEMENT
92
LASER DIODE COLLIMATING LENS ARRAYS
93
EDGE-EMITTING DIODE ARRAY
91
COUPLING PRISM ARRAY
DEVICE AREA
94

FIG. 17

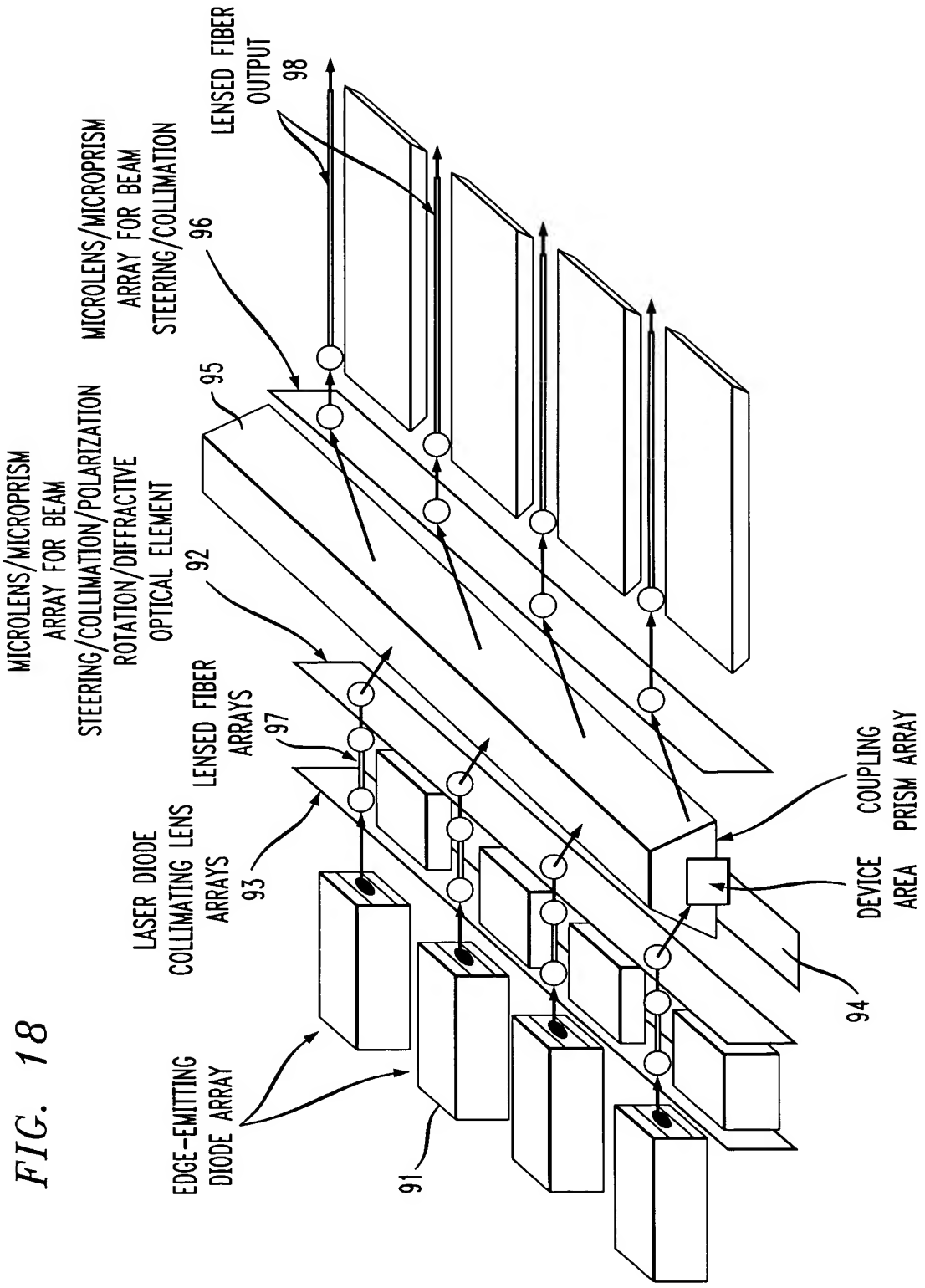

LENSED FIBER OUTPUT
98
MICROLENS/MICROPRISM ARRAY FOR BEAM STEERING/COLLIMATION
96
95
MICROLENS/MICROPRISM ARRAY FOR BEAM STEERING/COLLIMATION/POLARIZATION ROTATION/DIFFRACTIVE OPTICAL ELEMENT
92
LENSED FIBER ARRAYS
97
LASER DIODE COLLIMATING LENS ARRAYS
93
EDGE-EMITTING DIODE ARRAY
91
DEVICE COUPLING AREA PRISM ARRAY
94

FIG. 18

FIG. 19

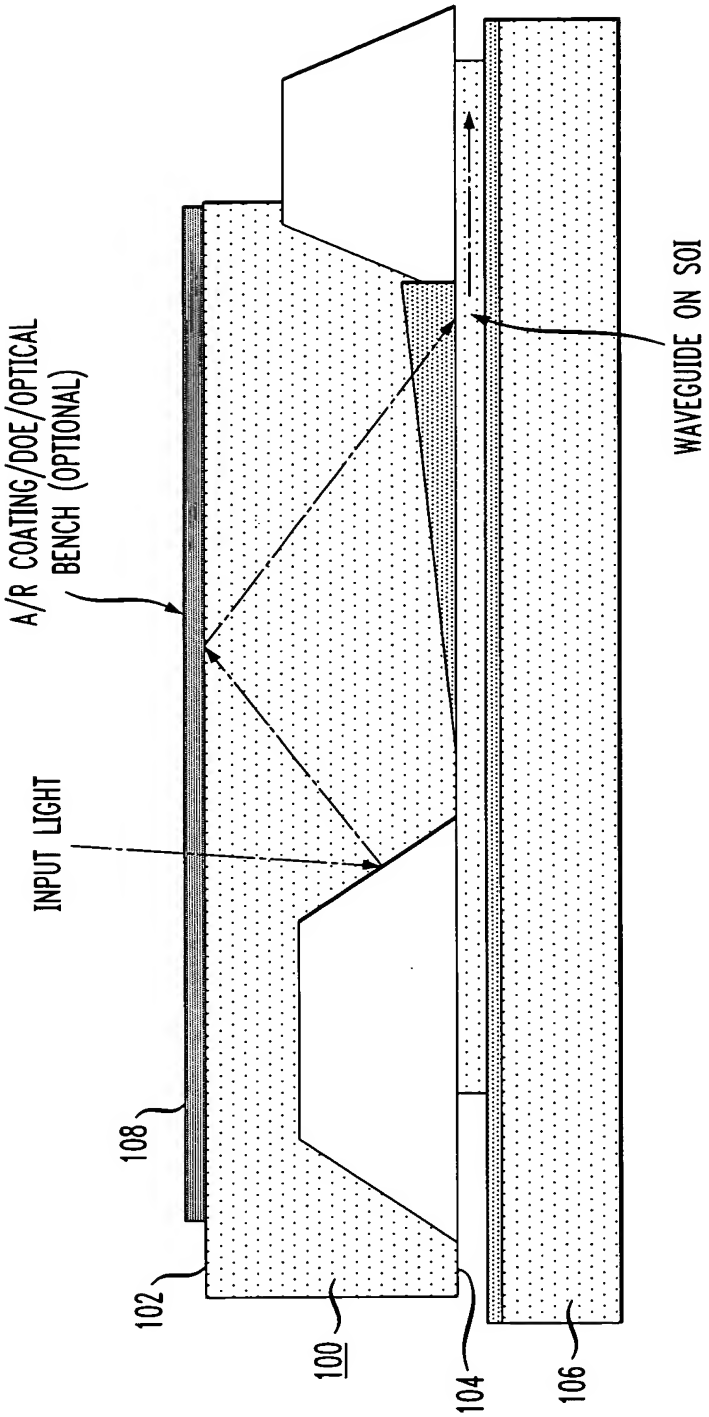

A/R COATING/DOE/OPTICAL BENCH (OPTIONAL)
INPUT LIGHT
WAVEGUIDE ON SOI
108
102
100
104
106

FIG. 20

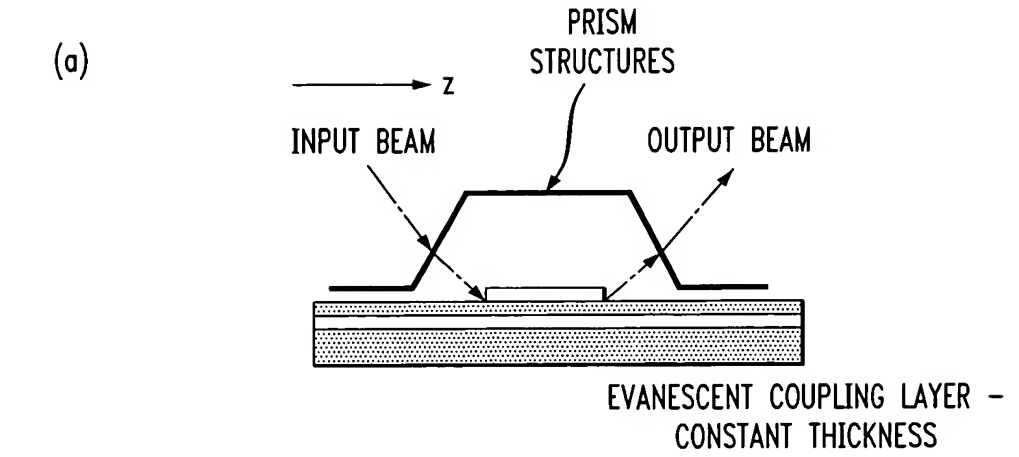

(a)
PRISM
STRUCTURES
z
INPUT BEAM
OUTPUT BEAM
EVANESCENT COUPLING LAYER -
CONSTANT THICKNESS
(b)
EVANESCENT
LAYER
THICKNESS-INPUT
z
EVANESCENT
LAYER
THICKNESS-OUTPUT
z
(c)
INPUT
BEAM
AMPLITUDE
z
POSITION OF INPUT
ETCHED CORNER
OUTPUT
BEAM
AMPLITUDE
z
POSITION OF OUTPUT
ETCHED CORNER
(d)
AMPLITUDES
FOR OVERLAP
INTEGREATION
INPUT
BEAM
OUTPUT
BEAM
z
POSITION OF
ETCHED CORNERS

FIG. 21

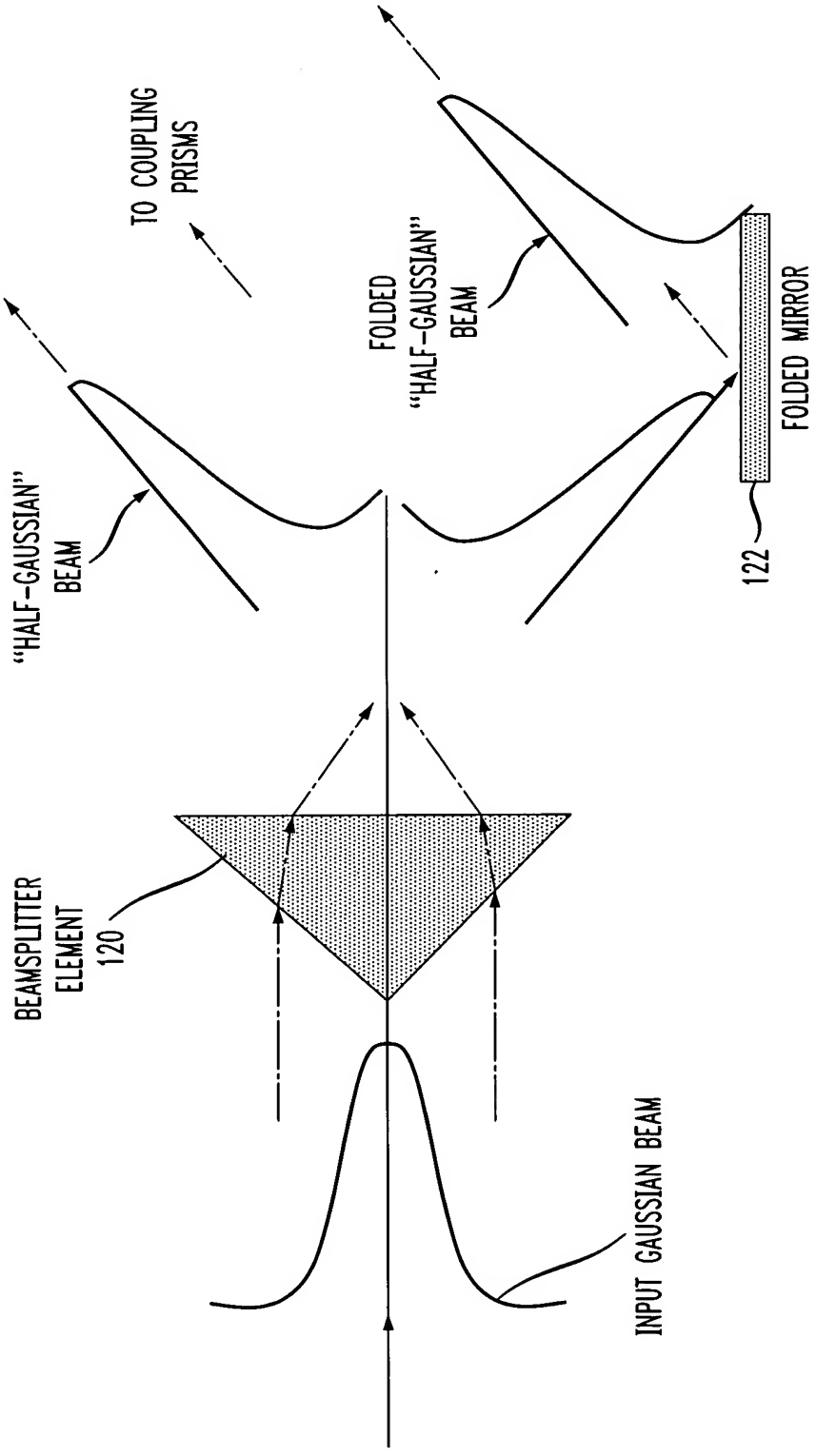
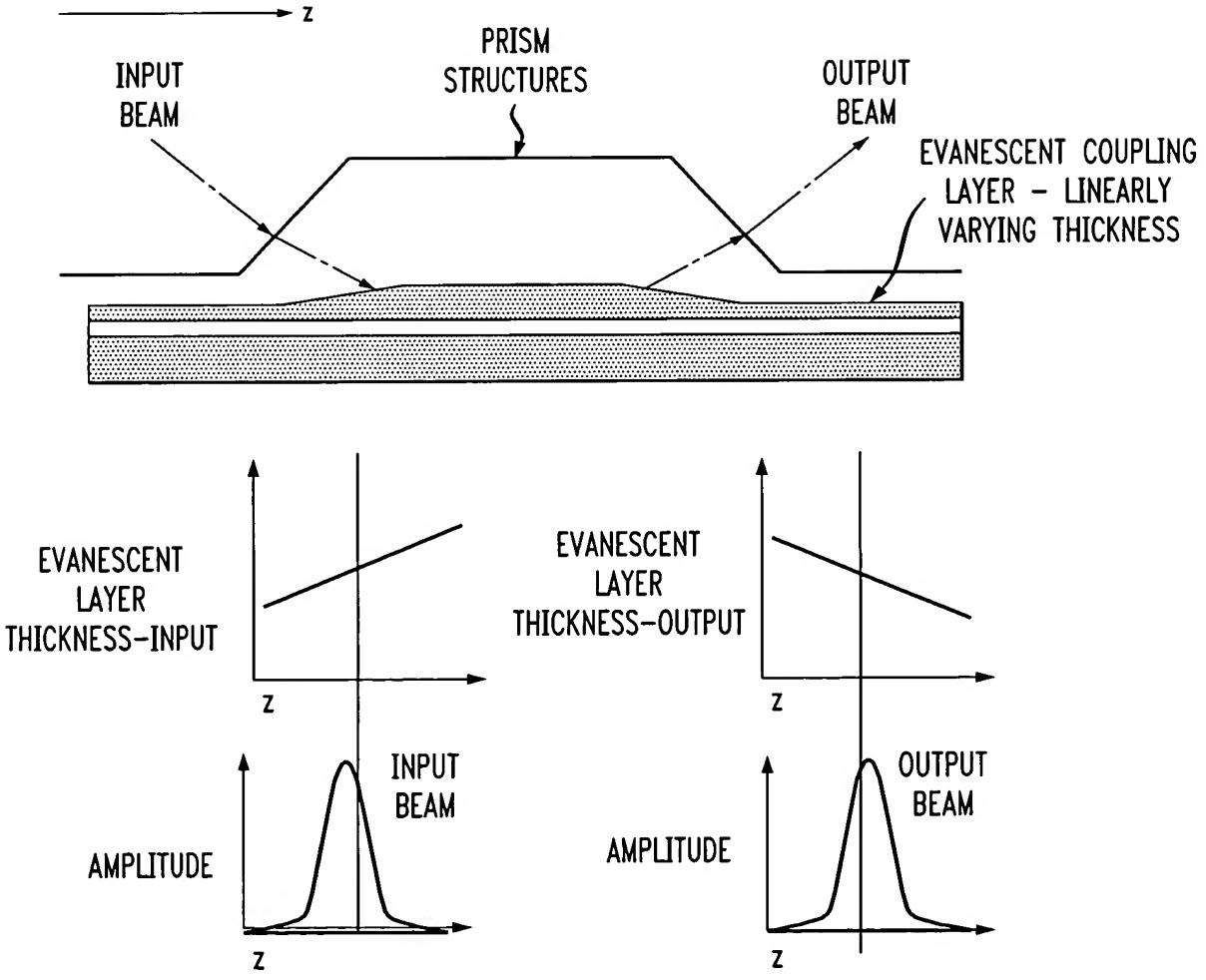

TO COUPLING PRISMS
FOLDED "HALF-GAUSSIAN" BEAM
FOLDED MIRROR
"HALF-GAUSSIAN" BEAM
122
BEAMSPLITTER ELEMENT 120
INPUT GAUSSIAN BEAM

FIG. 22


z
INPUT BEAM
PRISM STRUCTURES
OUTPUT BEAM
EVANESCENT COUPLING LAYER - LINEARLY VARYING THICKNESS
EVANESCENT LAYER THICKNESS-INPUT
z
INPUT BEAM
AMPLITUDE
z
EVANESCENT LAYER THICKNESS-OUTPUT
z
OUTPUT BEAM
AMPLITUDE
z